DOCUMENT RESUME

ED 224 463 IR 010 495

AUTHOR Poppenhagen, Brent W.; McArdle, Richard J.
TITLE Computer Simulation and Decision-Making: The Preparation of Mid-Level Managers for Higher Education.
PUB DATE Jul 82
NOTE 12p.; Paper presented at the International Conference on Improving University Teaching (8th, Berlin, West Germany, July 1982).
PUB TYPE Reports - Evaluative/Feasibility (142) -- Speeches/Conference Papers (150) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Attitude Measures; Attitudes; Budgeting; Computer Programs; *Decision Making; *Educational Administration; Graduate Students; Higher Education; *Management Games; *Models; Questionnaires; *Simulation
IDENTIFIERS *Resource Requirements Prediction Model

ABSTRACT

Experiential learning has seen limited application in the preparation of higher education administrators. During recent years, however, simulation games which link cognitive social science knowledge with management skills have been applied to classroom training in this field. A National Center for Higher Education Management Systems (NCHEMS) Resource Requirement Prediction Model (RRPM) was adapted and assessed for use as a simulation game. Subjects were 35 students enrolled in a master's degree course on the organization and administration of higher education. Using a simulation game involving teams, participants increased their ability to identify organizational variables and relate them to decision-making, while also increasing their ability to see relationships among variables and choose alternative decision-making paths. Most participants experienced a significant attitude change toward the use of this type of quantitative management tool and computer simulation. The report of this study includes a five-item bibliography and the Quantitative Methods Opinionnaire used to measure participants' attitudes. (Author/LMM)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED224463

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.

Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

COMPUTER SIMULATION AND DECISION-MAKING: THE PREPARATION OF MID-LEVEL MANAGERS FOR HIGHER EDUCATION

by

Brent W. Poppenhagen
and
Richard J. McArdle

IR010495

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Richard J. McArdle

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

COMPUTER SIMULATION AND DECISION-MAKING: THE PREPARATION OF MID-LEVEL MANAGERS FOR HIGHER EDUCATION

Brent W. Poppenhagen
and
Richard J. McArdle
The Cleveland State University

Abstract

Experiential learning has seen limited application in the preparation of higher education administrators. During recent years, however, simulation games which link cognitive knowledge from the social sciences with management skills have been applied to classroom training for this growing professional field. This paper describes the adaptation and assessment of a National Center for Higher Education Management Systems Resource Requirements Prediction Model for use as a simulation game. Participants increased their ability to identify organizational variables and relate them to decision-making, while also increasing their ability to see relationships among variables and choose alternative decision-making paths. Most participants experienced a significant change in their attitudes relative to the use of this type of quantitative management tool and computer simulation.

COMPUTER SIMULATION AND DECISION-MAKING: THE PREPARATION OF MID-LEVEL MANAGERS FOR HIGHER EDUCATION

Brent W. Poppenhagen and Richard J. McArdle
The Cleveland State University

Experiential learning has seen limited application in the preparation of higher education administrators. During recent years, however, simulation games which link cognitive knowledge from the social sciences with management skills have been applied to classroom training for this growing professional field. This paper describes the adaptation and assessment of a National Center for Higher Education Management Systems Resource Requirements Prediction Model for use as a simulation game. Participants increased their ability to identify organizational variables and relate them to decision-making, while also increasing their ability to see relationships among variables and choose alternative decision-making paths. Most participants experienced a significant change in their attitudes relative to the use of this type of quantitative management tool and computer simulation.

It can be said that informed decision-making is the most important function of college and university administrators. In light of this fact, the present paper describes the development and assessment of an instructional strategy which provides for decision-making practice, feedback, and more practice under simulated conditions. The overall goals of the simulation were to help potential middle managers to: a) systematically understand the institutional finance of a complex university; and b) make decisions based upon data from projected outcomes.

Conceptual Framework

Simulation gaming, though it has been applied to learning for many years, is now recognized for its appropriateness as an adult learning strategy. Despite this fact, higher education administrators have been reluctant to consider simulation games as worthy learning endeavors (2, p. 6).

Experiential learning has been thought of as appropriate to professional pre-

paration programs under specific conditions and at certain times. Traditionally, programs which train higher education administrators have required some type of practicum, internship, or other field-based activity. Typically, these are required to occur near the end of a graduate learning experience. Such requirements have been based on the notion that ultimately "to do is to understand."

Theoretically, according to Kolb, although persons early in life tend to adopt one learning style above others, the maturation process over the years should enable them to develop a more complex approach to learning. In other words ". . . growth proceeds from a state of embeddedness, defensiveness, dependency, and reaction, to a state of self-actualization, independence, proaction, and self-direction (4, p. 41)

In light of this developmental concept, the design of learning experiences (including simulation games) for adults becomes an opportunity and a challenge in that adults need to be accommodated as learners.

Development of the Simulation Game

Because it is used at colleges and universities across the United States, the National Center for Higher Education Management System's (NCHEMS) Resource Requirements Prediction Model (RRPM) (3) was selected as the basis for the simulated decision-making game. The RRPM model is the third of a series of increasingly sophisticated institutional finance software packages that have been developed by NCHEMS since the mid-1960's. NCHEMS models include the organizational data base of a small university (MICRO-U) with an enrollment of approximately two thousand students. MICRO-U data are normally used in testing RRPM software when first installed and prior to development of an institution's own data base. The MICRO-U data supplied the needed institutional data base for this simulation game.

Objectives for the game described in this article included:

1. To develop in each student knowledge of NCHEMS models with specific reference to RRPM.
2. To enable students to identify relevant organizational variables and their

relationships in administrative decision-making.

3. To provide students experience in making decisions that effectively work to resolve problems for a simulated higher education institution.

4. To provide students with experience in using a predictive simulation model in decision-making.

Lawrence and Service (5) report a certain inherent resistance among "middle managers" to the term "quantitative management." Resistance ". . . arises from the impression that such approaches are oriented only toward things and pay no attention to people" (5, p. 13). Recognizing that students may possess little knowledge of quantitative management techniques, but that gaming can embody a variety of modes for adult learning, a fifth learning objective was identified:

5. To significantly alter the feelings which students hold toward quantitative approaches to management.

Research Questions

The simulation game adopted for this study was assessed based upon three research questions:

1. Can a decision-making simulation assist students of higher education to recognize models available for help in decision-making for problem solution?

2. Can a decision-making simulation assist students of higher education to identify and relate institutional variables which might form the basis for problem solution?

3. Can students of higher education have their feelings toward quantitative approaches to higher education management significantly altered through practice with a data based prediction model?

Procedures

Gaming

The simulation and its assessment were conducted among a group of 35 subjects all enrolled in a master's degree course, Organization and Administration of Higher Education.[1] Ten of the participants held positions in higher education. The

---

[1] This course represents an introductory survey requirement of a master's degree program in higher education administration.

remaining participants had never worked in higher education and were new to the field as students.

Following orientation to NCHEMS and the RRPM model, participants were divided into teams of three to five members. Each team was asked to examine a printout showing MICRO-U's budget for one fiscal year. The teams were then supplied with a MICRO-U budget showing the addition of a new environmental studies major. Teams had the opportunity, therefore, to observe and study the systematic effect which program changes can have among all units of a university. Following this demonstration, teams were presented with a problem which required that MICRO-U's budget be decreased 10 percent. To accomplish this task, each team was allowed to manipulate a set of variables which included faculty salaries, administrative positions, class sizes, sections, additions and reductions in staff, and so forth. Decisions about where to cut, add, or retain, were made based upon each team's knowledge of MICRO-U's budget and how that budget reacted to changes. Team decisions were then processed using the RRPM model to generate a predicted MICRO-U budget. Second and third rounds of the game continued following the same format either in an attempt to adjust the effects of previous decisions or to practice potential solutions to new problems facing MICRO-U. While teams did compete to recognize the most effective problem resolution, cooperation among team members rather than competition among teams was the more encouraged outcome.

Assessment Methodology

Assessment focused on the administration of two instruments using a pre-test/post-test format. The first, or Institutional Problem Test (IPT) was designed to address research questions 1 and 2 concerning student's familiarity with and ability to identify quantitative models and institutional variables which might be important in decision making for problem solution. The test consisted of a briefly stated problem followed by five questions requiring subjective written answers.

Problem. The institution for which you are employed is considering increasing

the average section size of courses in order to off-set increased costs due to inflation. You have been asked to identify the savings that would be realized by this move.

Items which followed the problem statement included:

1. Do you know of any existing programs/models, etc. that you could consider to help you solve this problem?
2. What variables, in your opinion, would you need to consider in solving this problem?
3. Where would you most likely find data for each of these variables?
4. Which of these variables is most closely related to one or more other variables?
5. How many, if any, alternatives would you present in solving the problem?

The second test, or Quantitative Methods Opinionnaire (QMO), listed 19 items (Appendix), each of which expressed a feeling toward "quantitative approaches to higher education management," or, "computer simulations." Subjects were asked to identify the extent of agreement between the feeling expressed in the statement and their personal feeling.

Items from the IPT pre- and post-administrations were compared using a matched sample t-test to assess for significant difference between group means. Items from both administrations of the QMO were tabulated for each participant in two subsets: one set for items dealing with quantitative methods and a second set for items identifying computer simulation.

Results

Twenty-five sets of usable IPT data were returned by participants from the population of 35 course enrollees. Pre-test results indicated that five participants could identify an existing quantitative model that might have been of use in resolving the institutional problem. Twenty respondents knew of no models which might aid decision makers. Post-test results indicated that 23 subjects were able to identify at least one model (typically RRPM). The four remaining IPT

questions concerned identification, interrelationship, and alternative uses of institutional variables for problem resolution. Respondents to the pre-test identified a total of 25 variables. Cost per student, number of course offerings, and class size were mentioned by more than one subject. Post-test responses identified 18 variables with 10 variables being mentioned by more than one respondent. These variables were: faculty workload, section size, enrollment, FTE faculty, credit/contact hour ratio, salaries, support staff, product ratios, staff salaries, and number of chairmen. Each of these variables corresponds to variables utilized by the RRPM model. Post-test responses to IPT Items 3, 4, 5, and 6 reflected a similar shift from random association of perceived variables to the recognition of specific variables and their interrelationships as identified by RRPM.

Pre- and post-test data for the two subscales of the Quantitative Methods Questionnaire are reported in Table 1.

TABLE 1

PRE- AND POST-TEST RESULTS FOR SUBSETS OF THE QUANTITATIVE METHODS OPINIONNAIRE*

Subset	Mean (Pre-test)	S.D.	Mean (Pre-test)	S.D.	Mean Gain	S.D.	t	d.f.
#1	34.12	9.12	42.64	6.19	8.52	11.22	3.82**	24
#2	26.36	4.82	32.96	3.59	6.60	5.57	5.92**	24

* N = 25
** p .001
*** p .0001

For each subset, a gain score was calculated by subtracting the subject's pre-test total from the post-test total. The means and standard deviations for each subscale are also presented in Table 1. A matched-sample t-test was run with each set of gain scores to test the hypothesis (Research question 3) that the mean gain was equal to zero. Both tests yielded significant results. The gain scores

for subscale #1 (Quantitative approaches to higher education management) produced a t of 3.82, d.f. equal to 24, and p .001. The data for subscale #2 (Computer simulations) resulted in a t of 5.92, d.f. equal to 24 and p .0001.

Conclusion/Discussion

For purposes of this study, the authors limited themselves to determining whether or not certain useful behaviors could be taught through simulation. Simulation games have been advocated for preparing higher education administrators for several reasons:

1. They require a systems view of the organization.
2. They provide participants the opportunity to test their own assumptions, plans and decisions.
3. They encourage rational, sequential problem solving and decision-making.
4. Decisions made in a gaming environment can be evaluated immediately.

A review of the data presented earlier shows that the experiment was successful inasmuch as the objectives were achieved. Participants became knowledgeable of the NCHEMS material, especially the resource prediction model. The experiment provided them with an opportunity to use a predictive simulation model and an opportunity to practice making decisions. It was evident that after going through the experience the participants increased their ability to identify relevant organizational variables and to relate these variables to the decisions that had to be made. Students also demonstrated an increased ability to see the relationships among organizational variables and to choose alternative decision-making paths.

Through the use of the computer program that was part of the simulation, each team of participants could see the effects of their decision on the total MICRO-U program within twenty minutes of that decision. The discussions that followed helped participants realize the interrelatedness of many variables impacting on higher education. They were able to realize that adjusting one variable oftentimes has major impact on several others. As they analyzed their

decisions and had opportunities to repeat the exercise, they became more cognizant of the totality of an institution.

Theoretical learning has often been viewed as a classroom matter, while the business of clarification for understanding has been seen as occurring through practice in the field. While this strategy remains useful, it fails to accurately recognize recent research bearing upon adult developmental needs and specifically how adults learn. The use of simulated programs such as that described earlier has important implications for bridging this gap. Persons who have had an opportunity to practice decision-making in this type of simulated exercise should enter internships or other field learning activities with a better understanding of the totality of the institutional organization in which they are placed. This, hopefully, will help to maximize internship experiences both for the student and the institution.

BIBLIOGRAPHY

1. Dressel, P.L. and L.B. Mayhew. Higher Education as a Field Study. San Francisco: Jossey-Bass, Publishers, 1974.
2. Fincher, C. Simulation Techniques in Training College Administrators. Athens, Georgia: Institute of Higher Education, University of Georgia, 1974.
3. Gamso, G. The RRPM Guide: A Primer for Using the NCHEMS Resourse Requirements Prediction Model (RRPM 1.6). Boulder, Colorado: The National Center for Higher Education Management Systems, 1977.
4. Kolb, D.A. and R. Fry. "Toward an Applied Theory of Experiential Learning." Theories of Group Processes (C. Cooper, ed.). New York: Wiley, 1975.
5. Lawrence, G.B. and A.L. Service (Eds.). Quantitative Approaches to Higher Education Management. Washington, D.C.: American Association for Higher Education, 1977.

Appendix
Quantitative Methods Opinionnaire

Directions:
Each of the statements on this opinionnaire expresses a feeling which a particular person has toward Quantitative Approaches to Higher Education Management. You are to express, on a five point scale, the extent of agreement between the feeling expressed in each statement and your own personal feeling. The five points are: Strongly Disagree (SD), Disagree (D), Undecided (U), Agree (A), Strongly Agree (SA). You are to circle the letter(s) which best indicates how closely you agree or disagree with the feeling expressed in each statement AS IT CONCERNS YOU.

1. I feel very much tension and anxiety in courses which deal with quantitative methods.
   SD D U A SA
2. I do not like Quantitative Approaches to Management and it scares me to study them.
   SD D U A SA
3. Quantitative Methods are very interesting to me, I enjoy learning more about them.
   SD D U A SA
4. Computer simulations are fun.
   SD D U A SA
5. I feel comfortable with computer simulations and at the same time, they are exciting.
   SD D U A SA
6. I set up a wall or barrier when I hear the word quantitative.
   SD D U A SA
7. I feel very nervous about Quantitative Approaches to Management.
   SD D U A SA
8. Quantitative methods make me feel uncomfortable and impatient.
   SD D U A SA
9. I have a good feeling toward quantitative methods.
   SD D U A SA
10. Quantitative Approaches to Management make me feel as though I'm lost.
    SD D U A SA
11. Computer simulations are something that are enjoyable to me.
    SD D U A SA
12. When I hear the word computer I have a feeling of hate.
    SD D U A SA
13. I have a feeling of discomfort toward computer simulations.
    SD D U A SA
14. I like quantitative methods.
    SD D U A SA
15. I enjoy the study of quantitative methods.
    SD D U A SA
16 Computer simulations make me nervous.
    SD D U A SA
17. Reading quantitative materials makes me feel irritated and confused.
    SD D U A SA
18. I feel relaxed in computer simulation experiences.
    SD D U A SA
19. I feel very positive toward computer simulations, they are enjoyable.
    SD D U A SA